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THE GENUS *TOVARA* (*POLYGONACEAE*)HUI-LIN LI¹

THE broad concept of the genus *Polygonum* has been subject to repeated splitting in the past. In most cases, these segregates, maintained by certain authors but generally not accepted by most other taxonomists, have often been based on vegetative characters which are found to vary greatly in this group of plants. *Tovara*, however, is very distinct in having constant differences in the inflorescence and floral parts. Currently it is recognized by most authors as a generic entity distinct from *Polygonum*. The differences are as follows: In *Polygonum*, the calyx is 4–6-, mostly 5-parted, enlarging in fruit, and the segments are often

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petaloid and colored; the styles are 2 or 3, these being deciduous and not hooked; the flowers are either solitary or fasciated in the axils of leaves or bracts and they are arranged in spiciform panicles or in paniculate or corymbose racemes. In *Tovara*, the calyx is always 4-parted, scarcely enlarging in fruit, and the segments are green or reddish; the style is single, 2-parted to base and persistent as 2 deflexed hooked beaks of the achene; the flowers are remotely arranged in spike-like racemes with very elongate slender axes, 1-3 in each fascicle, and they soon become deflexed. The hooked beaks on the achene are very unique and undoubtedly aid in dispersal by animals.

The genus *Tovara* has also a distinct geographical range; like many other genera of this distribution pattern, it occurs disjunctly in eastern North America and eastern Asia only. One species is found in America, with a variety of very local occurrence. The taxonomy of the Asiatic plants is in a confusing state. They are recognized either as one or more varieties of the American species, or as one or several distinct species. However, the Asiatic plants differ from the American species in sufficiently constant morphological characters to be considered specifically distinct. The widespread species in temperate eastern Asia is now known as *T. filiformis*. A distinctly hirsute form is found in the southwesternmost range of the species, in southwestern China and the adjacent parts of Burma. Although it is strikingly distinct in general appearance, intermediate forms render its complete separation from the species impossible and it is here being treated as a variety. Another distinct population, which is of isolated range, being found only in Mindanao of the Philippines, is worthy of being considered a distinct species. A number of species have been proposed from time to time from Japan and the Liukius. When the widespread *T. filiformis* is studied from a large series of specimens from all localities within its range, the variable nature of the different parts of the plant shows that such local segregates are untenable.

The material used for this study is deposited in the U. S. National Herbarium (cited as US) and the Gray Herbarium of Harvard University (GH). The collections in the herbarium of the National Taiwan University, Formosa (NTU), have also been examined.

KEY TO THE SPECIES AND VARIETIES

- A. Plants pubescent or rarely glabrous; leaves ovate, acute to rounded and not attenuate at base, the lateral veins 7–9 per side; calyx green, rarely rosy (Eastern North America).
- B. Stems pubescent; leaves thin-chartaceous, usually pubescent beneath, strigose or often scabrid above; rhizomes thick, knotty.....1a. *T. virginiana* var. *virginiana*.
- BB. Stems glabrous or glabrate; leaves thin-chartaceous to membranaceous, glabrous or glabrate; rhizomes slender, cord-like.....1b. *T. virginiana* var. *glaberrima*.
- AA. Plants more or less hirsute-pubescent throughout, especially on pedicels and sheaths; leaves more or less obovate, the base acute to cuneate, attenuate, the lateral veins 7–13 per side; calyx dark red (Eastern Asia).
- B. Rhizomes thick, knotty; plants tall, 60 cm. or more high; leaves large, over 9 cm. long, acuminate at apex, broadly cuneate at base, the lateral veins 11–13 per side; flowers more densely arranged, 2 or more fascicles per cm. of the rachis.
- C. Pubescence more or less scattered, short; leaves generally broader, about 10–16.5 cm. long and 4–7.5 cm. broad.....2a. *T. filiformis* var. *filiformis*.
- CC. Pubescence very dense, long, and coarse; leaves narrower, about 9–16.5 cm. long and 2–5.5 cm. broad
2b. *T. filiformis* var. *kachina*.
- BB. Rhizomes slender, not knotty; plants lower, to 60 cm. high; leaves smaller, 5–8 cm. long, obtuse or broadly acute at apex, narrowly cuneate at base, the lateral veins 7–11; flowers more scattered, 0.5–1 per cm. of the rachis.....3. *T. apoënsis*.

1. *Tovara virginiana* (L.) Raf. Tellur. 3: 12. 1836.

A slender erect plant, 45–60 cm. or more high, strigose-pubescent or nearly glabrous throughout; rhizomes slender and cord-like or thick and knotty; stems terete, simple or virgately branched especially above; sheaths membranaceous, cylindric, pubescent, the margins ciliate-fringed; leaf-blades thin-chartaceous to membranaceous; ovate to broadly lanceolate, about 5–15.5 cm. long, 2–10 cm. broad, acuminate at apex, acute to rounded at base, not attenuate, usually pubescent beneath and finely and softly strigose and often slightly scabrous above or glabrous or promptly glabrate on both surfaces, the main lateral veins about 7–9 per side; petioles 3–10 mm. long. Inflorescence consisting of 1 or several elongated spicate racemes, the leading ones to 20 cm. or more long, the flowers 1–3-fascicled, these scattered, 1–1.3 per cm. of the rachis, the rachis pubescent, often glabrous above; ocreole funnelform, 2 mm. long, glabrous, the margins ciliolate at top; pedicels scarcely 1 mm. long; calyx greenish or rose-colored, about 3 mm. long, usually 4-parted to the middle or to the base, scarcely enlarging in fruit; stamens 5, included; styles 3 mm. long, 2-parted to the base, long-exserted, the segments reflexed at tip. Achene brown, shining, ovoid, about 3.5 mm. long and 2.5 mm. across, pointed at apex with 2 styles 3 mm. long.

1a. *Tovara virginiana* (L.) Raf., var. *virginiana*.

Tovara virginiana Raf. Tellur. 3: 12. 1836; Fernald, Gray's Manual ed. 8. 571. 1950. *Polygonum virginianum* L. Sp. Pl. 360. 1753. *Persicaria virginiana* Gaertn. Fruct. 2: 180. pl. 119, f. 3. 1791. *Polygonum muticum* Moench. Meth. Suppl. 266. 1802.

An erect, slender plant, 60 cm. or more high; rhizomes thick, knotty; stems slightly pubescent; leaves chartaceous, firm, usually pubescent beneath, strigose or often scabrid above; calyx green, rose-red in f. *rubra*.

Widely distributed in eastern North America, in rich woodlands and thickets, from southern Quebec and western New Hampshire to southern Ontario and Minnesota, south to Florida, Alabama, Mississippi, Louisiana, and eastern Texas. Flowering July–October. (All cited specimens are from U. S. Nat. Herb.).

CANADA:—**Ontario:** *J. Macoun* in 1892. U. S. A.:—**New Hampshire:** *Weatherby & Upham* in 1942. **Massachusetts:** *H. A. Purdie* in 1903, *J. R. Churchill* in 1887. **Connecticut:** *E. H. Eames* in 1894. **Rhode Island:** *P. Spaulding* in 1916. **New York:** *O. P. Phelps* 401, *A. K. Harrison* in 1889, *Standley & Bollman* 12321, **New Jersey:** *W. M. Van Sickle* in 1895. **Pennsylvania:** *T. C. Porter* in 1895, *A. A. Heller* in 1889, *J. K. Small* in 1890, *L. K. Henry* 528. **Ohio:** *C. W. Short* s. n., *A. E. Ricksecker* in 1894, *E. O. Wooton* in 1896, *E. S. Steele* in 1910, *D. Demaree* 11596. **Illinois:** *H. H. Babcock* in 1871, *L. M. Umbach* in 1896, *M. S. Bebb* s. n., *E. S. Steele* in 1910, *V. H. Chase* 8387, *C. Gates* 1954. **Indiana:** *W. L. Hahn* in 1906, *B. W. Evermann* 992, 1050, *C. C. Deam* 154. **Michigan:** *A. A. Croizer* in 1886, *G. B. Sudworth* in 1890, *F. J. Hermann* 9218, *W. F. Wight* 29, *O. E. Lansing, Jr.*, 3329. **Minnesota:** *C. A. Ballard* in 1892. **Iowa:** *M. P. Somes* 3783, *B. Fink* 267, *J. H. Mills* 532. **Kansas:** *J. B. Norton* 462, *T. T. Crevicœur* 33. **Missouri:** *P. C. Standley* 8342, 9645, *B. F. Bush* 415, *W. W. Eggleston* 12157. **Kentucky:** *C. W. Short* in 1840, *T. H. Kearney Jr.* 515, *H. W. Lix* 471. **Tennessee:** *A. Ruth* 181, *A. H. Curtis* 2413, *W. B. McDougall* 1450. **West Virginia:** *E. S. Steele* in 1898. **Virginia:** *T. H. Kearney Jr.* 2183, *Fernald & Long* 8251. **Maryland:** *J. D. Smith* in 1878, *E. S. Steele* in 1910. **North Carolina:** *R. K. Godfrey* 6311, *P. C. Standley* 5572, *W. W. Ashe* 2379. **South Carolina:** *Godfrey & Tryon* 1516, *H. D. House* 2920. **Georgia:** *R. M. Harper* 305. **Florida:** *W. A. Murrill* 502, *A. Fredholm* 261. **Alabama:** *C. Mohr* in 1892, *E. A. Smith* in 1874, *G. McCarthy* in 1888, *S. M. Tracy* 8034. **Mississippi:** *S. M. Tracy* 8767. **Louisiana:** *E. J. Palmer* 8861. **Arkansas:** *D. Demaree* 8247. **Oklahoma:** *J. H. Kimmons* in 1895, *G. W. Stevens* 2127. **Texas:** *J. Reverchon* 2145, *V. L. Cory* 49842, *F. W. Thurow* 3, *G. L. Fisher* 105.

A form with bright pink or reddish fruiting calyx, *T. virginiana* f. *rubra* Moldenke in *Boissiera* 7: 4. 1943, is recorded from Ohio, near Fresno, in open woodland.

1b. **Tovara virginiana** (L.) Raf. var. **glaberrima** Fernald in *RHODORA* 39: 404. 1937.

Slender plant, 45 cm. or more high; rhizomes elongate, slender, cord-like; stems glabrous or glabrate; leaves membranaceous, thin, glabrous or promptly glabrate, usually pubescent along the main veins beneath.

Southeastern United States, rich low woods and flooded bottoms, from southern Virginia to South Carolina.

U. S. A.:—**Virginia:** *Fernald & Long* 6201 (GH), 6202 (GH), 6703 (GH, type), 7431 (GH), 7432 (GH), 9319 (GH, US); *Fernald, Griscom & Long* 6591 (GH, US); *R. K. Godfrey & R. M. Tryon Jr.* 1516 (US). **South Carolina:** *Godfrey* 8164 (GH, US), *H. W. Ravenel* s. n. (GH).

2. *Tovara filiformis* (Thunb.) Nakai in Rigakki 29(4): 8. 1926.

A tall herb, 60 cm. or more high; rhizomes very thick, subligneous, knotty; stems terete, more or less pubescent to hirsute throughout; sheaths membranaceous, cylindric, more or less densely yellowish-brown strigose, the margins ciliate-strigose; leaf-blades membranaceous to chartaceous, obovate to obovate-oblong or obovate-lanceolate, 10–16.5 cm. long, 2–7.5 cm. broad, acuminate at apex, broadly cuneate at base, dark green above, pale beneath, glabrate to densely strigose on both surfaces, the main lateral veins 11–13 per side; petioles 1–1.5 cm. long, canaliculate above, strigose-pubescent to hirsute-strigose throughout. Inflorescence in long slender terminal or axillary racemes, 40–60 cm. long, usually 2–several-branched, the flowers 1–3-fascicled, these scattered, 2 or more per cm. of the rachis; rachis pubescent; ocreole tubular, scabrid-strigose, the margins long-strigose-ciliate; pedicels slender, to 2 mm. long; calyx reddish, 3 mm. long, scarcely enlarging in fruit. Achene brown, shining, ovoid, 2.5–3 mm. long, 1.5–2.5 mm. broad, pointed at apex with 2 styles 2–2.5 mm. long.

2a. *Tovara filiformis* (Thunb.) Nakai var. *filiformis*.

Tovara filiformis (Thunb.) Nakai in Rigakki 29 (4): 8. 1926; Maekawa in Bot. Mag. Tokyo 46: 587. f. 13, F. 1932. *Polygonum filiforme* Thunb. Fl. Jap. 163. 1784. *Polygonum virginianum* var. *filiforme* Nakai in Bot. Mag. Tokyo 27: 380. 1909; Merr. in Journ. Arnold Arb. 21: 367. 1940. *Persicaria filiformis* Nakai, Fl. Quelpart Is. 41. 1914. *Polygonum neofiliforme* Nakai in Bot. Mag. Tokyo 36: 117. 1922. *Tovara neofiliformis* Nakai in Rigakki 29 (4): 8. 1926; Maekawa in Bot. Mag. Tokyo 46: 586. f. 13, N. 1932. *Persicaria neofiliforme* Ohki in Bot. Mag. Tokyo 40: 57. 1926. *Tovara virginiana* var. *filiformis* Steward in Contr. Gray Herb. no. 88: 14. pl. IA. 1930. *Tovara smaragdina* Nakai ex Maekawa in Bot. Mag. Tokyo 46: 585. f. 13, S. 1932. *Tovara ryukyuensis* Masamune in Trans. Nat. Hist. Soc. Formos. 29: 60. 1939. *Polygonum virginianum* sensu Hook. f. Fl. Brit. Ind. 5: 31. 1886; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26: 352. 1891; Samuelsson ex Hand.-Mazz. Symb. Sin. 7: 172. 1929; non L.

A tall herb, 60 cm. or more high, more or less scabrid-pubescent throughout. Leaves membranaceous to thin-chartaceous, broadly obovate to obovate-oblong, 10–16 cm. long, 4–7.5 cm. broad, glabrate to more or less scattered short-strigose; petioles and sheaths hirsute-pubescent.

Eastern Asia from southern Korea, Japan, Liukiu, Formosa to southern and southwestern China and the Himalayas, in thickets and damp places, on mountain slopes, in ravines, or at stream sides, from 600 to 1200 meters.

KOREA:—**Quelpart**: R. K. Smith in 1934 (US). **Chiisan**: K. Uno 2598 (GH). JAPAN:—**Hokkaido**: Maximowicz in 1861 (GH, US), Dr. Albrecht in 1861 (GH), S. Arimoto s. n. (GH); Dorsett & Morse 1176 (US). **Hondo**: Tokyo Mus. 393 (US), J. Matsumura in 1879 (US), E. Elliot 12 (GH, US), D. Savatier 1031 (US), R. Tomioku 6976 (GH), R. K. Beatie & Y. Kurihara 10335 (US), S. Suzuki 9378 (GH), H. Sasaki 6931 (GH), K. Shiota 3851, 3881, 3882, 6968, 7874, 8048 (GH), I. Kato 6911 (GH), 6932 (GH), T. Kato 9156 (GH). LIUKIU:—**Okinawa**: N. Fukuyama 7196 (NTU, type of *T. ryukyuensis* Masamune). CHINA:—**Shangtung**: C. Y. Chiao 2863 (GH, US). **Kiangsu**: Nanking U. Herb. 229 (GH, US), K. Ling 12532 (GH). **Chekiang**: R. C. Ching 2322 (GH, US), 9090 (US), S. Barchet 5817 (US), Cheo & Wilson 12687 (GH), K. Ling 2843 (GH). **Hupei**: A. Henry 4123 (US), 4784 (GH). **Kiangsi**: H. C. Cheo 83 (US), S. K. Lau 4538 (US), 4816 (GH, US). **Hunan**:

H. Handel-Mazzetti 12636 (US), *C. S. Fan & Y. Y. Li* 483 (GH). **Szechuan:** *W. P. Fang* 2270 (GH), 2471 (GH), 5260 (GH, US), *T. C. Peng* 60 (US). **Kweichow:** *Y. Tsiang* 8719 (US), *Steward, Chiao & Cheo* 310 (US). **Kwang-si:** *W. T. Tsang* 28213 (US), 28416 (US). **Kwangtung:** *W. T. Tsang* 21491 (GH), *S. K. Lau* 2510 (GH). **INDO-CHINA:—Tonkin:** *A. Pételot* 2232 (US). **KASHMIR:** *R. R. Stewart* 17394 (GH).

Japanese botanists recognize three species of *Tovara* in Japan, namely, *T. filiformis*, *T. neofiliformis*, and *T. smaragdina*. Steward earlier reduced *T. neofiliformis* to the synonymy of *T. filiformis* on the basis of its descriptions, and I fully concur with his judgment. Maekawa (in *Bot. Mag. Tokyo* **46**: 585–586. *f. 13*. 1932) distinguishes the three species, aside from the shape and pubescence of the leaves, both of which variable characters are indistinctly defined by him, especially by the shape and size of the achene as follows:

T. filiformis: “Nux late ovata 2.2–2.8 mm. longa 1.8–2.2 mm. lata basi obtusissima.”

T. neofiliformis: “Nux major oblonga vel ovato-oblonga 2.8–3.3 mm. longa 1.8–2.2 mm. lata basi subrotunda.”

T. smaragdina: “Nux oblongo-ovoidea 2.2–2.5 mm. longa 1.3–1.4 mm. lata basi late cuneata”.

In his illustration, however, the bases of the fruits are more or less similarly depicted. It is also impossible in practice to differentiate species on the basis of the narrow ranges of measurements of the achene as given by him. Specimens from different parts of the Chinese mainland show much wider variations in both shape and pubescence of leaves and shape and size of the achene. (The achene is in general smaller than in the American *T. virginiana*.) Furthermore such variations occur in various intergrading forms that make distinctions impossible. If these variations are recognized on the same basis as those proposed as Japanese species, the number of taxonomic entities, whether as species, varieties, or forms, will be multiplied to such an extent as to make them useless. These species are therefore reduced to straight synonyms of *T. filiformis*. *Tovara ryukyuensis* Masamune is reduced on the basis of the type. An attempt to divide this species intraspecifically might be made on a geographical basis, covering the entire range, but only with a much larger series of specimens than is now available.

2b. ***Tovara filiformis*** (Thunb.) Nakai var. ***kachina*** (Nieuwland) comb. nov.

Tovara virginiana var. *kachina* Nieuwland in Am. Midl. Nat. 2: 182. 1912; Steward in Contr. Gray Herb. no. 88: 14. 1930.

A tall herb 45–60 cm. high, more densely strigose throughout than in var. *filiformis*; leaves chartaceous, obovate-lanceolate, 9–16.5 cm. long, 2–2.5 cm. broad, densely long-strigose on both surfaces; petioles and sheaths densely brown hirsute-strigose.

Upper Burma and southwestern China, in thickets and forests at altitudes of 2,000–3,000 meters.

BURMA:—Upper Burma: *S. Mokin* in 1897 (US, type), *G. Forrest 26374* (US). CHINA:—Kweichow: *O. Schoch 409* (GH, US).

3. ***Tovara apcönsis*** (Elmer) comb. nov.

Polygonum apoënsse Elmer, Leaf. Philip. Bot. 8: 2796. 1915; Merr. Enum. Philip. Fl. Pl. 2: 121. 1923. *Tovara virginiana* var. *apoënsis* Steward in Contr. Gray Herb. no. 88: 14. *pl. IC*. 1930.

An erect plant, 40–60 cm. high; rhizome slender; stems terete, the young stems yellowish-strigose; sheaths submembranaceous, cylindrical, 1–1.5 cm. long, yellowish-brown strigose especially toward the margins, the margins bristly; leaf-blades submembranaceous, obovate to obovate-oblong, 5–8 cm. long, 2–3.5 cm. broad, bluntly acute at apex, cuneate at base, entire at margins, dark green and glabrate above, much lighter and minutely puberulent or subglabrate beneath, the costa puberulent on both surfaces, the main lateral veins about 7–11 per side; petioles 1.2–2 cm. long, deeply canaliculate above, short-strigose beneath, ciliate upon the upper lateral margins. Inflorescence racemose, usually unbranched, rarely 2- or 3-branched at base, subterminal, erect, ascending, varying greatly in length from 10 to 30 cm. long or even longer, very slender, the flowers usually 1–3-fascicled, scattered, 0.5–1 per cm. of the rachis, the rachis puberulent; ocreole 3 mm. long, glabrous within, yellowish-brown ciliate without and along the upper margin; pedicels stout, 2 mm. long, glabrous; calyx deep purple-red, about 3.5 mm. long, scarcely enlarging in fruit; ovary obovoid, 0.75 mm. long, glabrous, the styles 2, fleshy, glabrous.

Philippine Islands, in Mindanao only, in rich soils of open glens of dense forests at about 1,250 meters.

PHILIPPINES:—Mindanao: *A. D. E. Elmer 10954* (US, isotype), *R. J. Alvarez 25230* (US).

This species is generally a smaller plant than *T. filiformis* and with its smaller leaves more cuneate and attenuate at the base. The inflorescence is also more sparsely branched, and the flowers much more scattered.

GLYCERIA SEPTENTRIONALIS AND *G. ACUTIFLORA* IN LEE, NEW HAMPSHIRE.—The Lamprey River which, in its lower course, passes through the townships of Epping, Lee, Durham, and Newmarket has proved to be a good collecting area for the botanist. In Epping one of the best stations that A. A. Eaton knew for *Isoetes* was the broad pond-like part of the stream back of the dam in West Epping. In Lee below Wadleigh's Falls is a